

### REMARKS

Reconsideration and allowance of the present patent application based on the following remarks are respectfully requested. Since this Amendment is being presented together with a Request for Continued Examination, entry of this Amendment is respectfully requested.

As a preliminary matter, Applicant would like to express appreciation for the courtesies extended by Examiner Landau to Applicant's representative during the interview conducted on May 31, 2006 (hereinafter the "Interview"). The substance of the interview is incorporated into the remarks below and constitutes Applicant's record of the interview.

By this Amendment, claims 1 and 7 are amended and claims 13 and 14 are newly added. Support for the amendments to claims 1 and 7 and new claims 13 and 14 can be found throughout the original disclosure. No new matter has been added. Accordingly, after entry of this Amendment, claims 1-14 will remain pending in the patent application.

Claims 1, 2, 4 and 7 were rejected under 35 U.S.C. §102(e) based on Callegari *et al.* (U.S. Pat. No. 6,664,186) (hereinafter "Callegari"). The rejection is respectfully traversed.

Claim 1 is patentable over Callegari at least because this claim recites a barrier structure for copper metallization, comprising, *inter alia*, an oxide film formed by oxidizing an upper part of the first Ru layer and a second Ru layer formed in contact with the oxide film. Callegari does not disclose, teach or suggest these features.

Callegari discloses a trench capacitor and a method for manufacturing the same. The trench capacitor is formed on a substrate 30 and includes successively an optional conductive barrier layer 32, a bottom electrode layer 33, a dielectric layer 34, a top electrode layer 35, an optional dielectric layer buffer layer 36, a diffusion barrier 81 and a metallization barrier 82. (See, e.g., FIG. 28 of Callegari). The optional conductive barrier layer 32 (identified by the Office Action as "the first Ru layer" of claim 1) may include Ru or RuO<sub>2</sub>. (See, e.g., col. 15, lines 9-16 of Callegari). The bottom electrode layer 33 (identified by the Office Action as "the oxide film" of claim 1) may include RuO<sub>2</sub>. (See, e.g., col. 15, lines 16-19 of Callegari). The top electrode layer 35 (identified by the Office Action as "the second Ru layer" of claim 1) may include Ru. (See, e.g., col. 15, lines 39-43 of Callegari).

However, unlike claim 1 and as conceded during the Interview, Callegari is silent as to a second Ru layer formed in contact with an oxide film that includes RuO<sub>2</sub>, much less with a film that was formed by oxidizing Ru. Callegari merely discloses that the top electrode layer 35 (identified by the Office Action as "the second Ru layer" of claim 1) is formed in contact with the dielectric layer 34 that includes aluminum oxide. (See, e.g., FIG. 28 and col. 15,

lines 20-23 of Callegari). In Callegari, the only film that is formed in contact with the bottom electrode 33, which could include RuO<sub>2</sub>, is the dielectric layer 34. However, this dielectric layer 34 does not contain Ru because it is designed to be resistive and to act as the dielectric of the trench capacitor. As such, since Callegari does not disclose, teach or suggest a second Ru layer formed in contact with an oxide film that was formed by oxidizing Ru, Callegari cannot anticipate claim 1.

Claims 2 and 4 are patentable over Callegari at least by virtue of their dependency from claim 1 and for the additional features recited therein.

Claim 7 is patentable over Callegari for at least similar reasons as provided above in claim 1 and for the additional features recited therein. Namely, claim 7 is patentable over Callegari at least because this claim recites a method for fabricating a barrier structure for copper metallization, comprising forming an oxide film in a surface region of the first Ru layer and forming a second Ru layer in contact with the oxide film. As mentioned previously, these features are not disclosed in Callegari. As such, Callegari cannot anticipate claim 7.

Accordingly, reconsideration and withdrawal of the rejection of claims 1, 2, 4 and 7 under 35 U.S.C. §102(e) based on Callegari are respectfully requested.

Claims 3 and 5 were rejected under 35 U.S.C. §103(a) based on Callegari. This rejection is respectfully traversed.

Claims 3 and 5 are patentable over Callegari at least by virtue of their dependency from claim 1 and for the additional features recited therein. Namely, claims 3 and 5 are patentable over Callegari at least because this claim recites a barrier structure for copper metallization, comprising, *inter alia*, an oxide film formed by oxidizing an upper part of the first Ru layer and a second Ru layer formed in contact with the oxide film. As explained by Applicant's representative during the interview, one of ordinary skill in the art would not be motivated to modify Callegari to provide these features.

Specifically, Callegari's trench capacitor is a resistive structure in that it is designed to prevent current from flowing between the top electrode 35 (which could include Ru) and the bottom electrode 33 (which could include RuO<sub>2</sub>). As such, there is clearly no motivation to modify Callegari's structure in order to place the top electrode layer 35 in contact with the bottom electrode 33, since this modification would render Callegari's trench capacitor inoperative and thus would defeat the intended purpose of Callegari, which is to provide a resistive dielectric layer between the bottom electrode 33 and the top electrode 35. As such, Applicant respectfully submits that claims 3 and 5 cannot be rendered obvious in view of Callegari.

Accordingly, reconsideration and withdrawal of the rejection of claims 3 and 5 under 35 U.S.C. §103(a) based on Callegari are respectfully requested.

Claim 6 was rejected under 35 U.S.C. §103(a) based on Callegari in view of Zurcher *et al.* (U.S. Pat. No. 6,344,413) (hereinafter "Zurcher"). The rejection is respectfully traversed.

Claim 6 is patentable over Callegari at least by virtue of its dependency from claim 1 and for the additional features recited therein. Namely, claim 6 is patentable over Zurcher at least because this claim recites a barrier structure for copper metallization, comprising, *inter alia*, an oxide film formed by oxidizing an upper part of the first Ru layer and a second Ru layer formed in contact with the oxide film.

Zurcher fails to remedy the deficiencies of Callegari. Zurcher discloses a method for manufacturing a capacitor, but is silent as to the above recited features of claim 6. As such, any reasonable combination of Callegari and Zurcher cannot result, in any way, in the invention of claim 6.

Furthermore, Applicant respectfully submits that there is no motivation or suggestion for one of ordinary skill in the art to modify Callegari for at least the same reasons provided above in connection with claims 3 and 5.

Accordingly, reconsideration and withdrawal of the rejection of claim 6 under 35 U.S.C. §103(a) based on Callegari in view of Zurcher are respectfully requested.

Claims 13 and 14 are newly added to define additional subject matter that is novel and non-obvious. Claims 13 and 14 are patentable over the art of record at least by virtue of their dependency from claims 1 and 7, respectively. Accordingly, Applicant respectfully submits that claims 13 and 14 are allowable.

Applicant respectfully submits that claims 1-7 are allowable and request that claims 8-12, which depend from claim 7, be rejoined.

In view of the above amendments and remarks, Applicant respectfully submits that all of the claims are allowable and that the entire application is in condition for allowance.

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Should the Examiner believe that anything further is desirable to place the application in better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number listed below.

Please charge any fees associated with the submission of this paper to Deposit Account Number 033975. The Commissioner for Patents is also authorized to credit any over payments to the above-referenced Deposit Account.

Respectfully submitted,

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